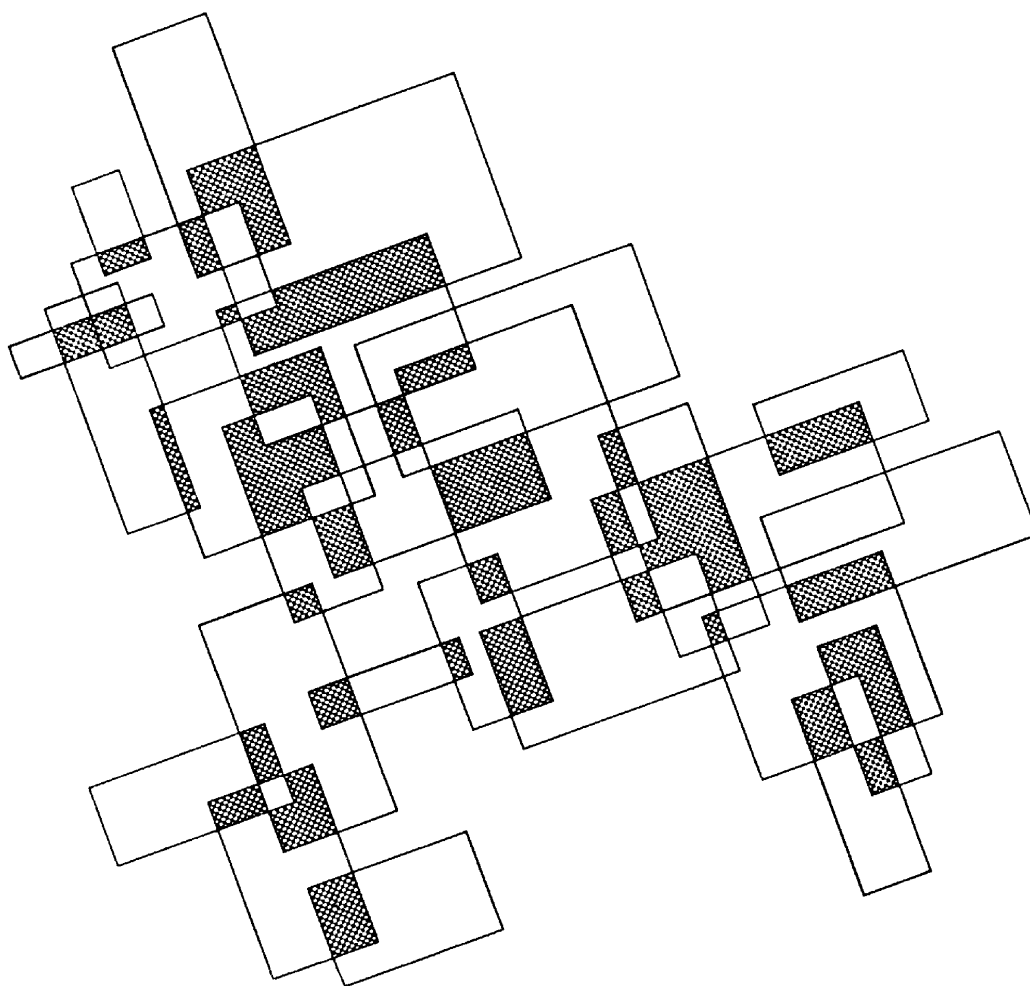


NIST Special Publication 500-258

Information Technology:

DVD Drive Compatibility Test (Phase 2) for DVD-R(General) and DVD+R Discs, including DVD Creation Plan.



NIST

National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

Information Technology:

**DVD Drive Compatibility Test (Phase 2)
for DVD-R(General) and DVD+R Discs,
including DVD Creation Plan.**

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September 2004



U.S. Department of Commerce
Donald L. Evans, Secretary

Technology Administration
Phillip J. Bond, Under Secretary of Commerce for Technology

National Institute of Standards and Technology
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Reports on Information Technology

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Preface

The Information Access Division (IAD) of the Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST), in collaboration with the Optical Storage Technology Association (OSTA) and the DVD association (DVDA) has developed this plan to test the compatibility of various DVD drives with various types of DVD media.

About the DVD Association (DVDA)

The DVDA is a nonprofit organization funded through membership dues and corporate sponsorships. Membership is open to all those connected in any way with the creation of DVD titles. The bulk of DVA members are developers that specialize in the creation of multimedia programs for training, education, presentations and entertainment using the DVD platform. The DVDA represents many of the most experienced producers of professional applications in the industry. For more information visit www.dvda.org

About the Optical Storage Technology Association (OSTA)

The Optical Storage Technology Association (OSTA) was incorporated as an international trade association in 1992 to promote the use of recordable optical technologies and products. The organization's membership includes optical product manufacturers and resellers from three continents, representing more than 85 percent of worldwide writable optical product shipments. They work to shape the future of the industry through regular meetings of DVD Compatibility, Commercial Systems Applications (CSA) Marketing, MPV, Planning and UDF committees. Interested companies worldwide are invited to join the organization and participate in its programs by contacting an OSTA representative at +1 (408) 253-3695, by fax +1 (408) 253-9938 or by addressing its Web site at www.osta.org.



The OSTA DVD Compatibility Committee:

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Acknowledgements:

The DVD compatibility committee would like to thank Ralph LaBarge and OSTA member manufacturers for their input to this document. Also Siva Srinivasan and Alexei Nikolaev of NIST for help developing the test software. Acknowledgment is also given to the NIST Information Access Division (IAD) and ITL management for their support of this project.

1 Introduction:

This phase 2 test procedure is designed to test the compatibility of DVD drives with DVD writable media including DVD-R (for general) and DVD+R. The test plan includes detailed instructions on how to create and test the recordable media and how to determine the result from each test.

Following implementation of Phase 1 (NIST Special Publication 500-254), the National Institute of Standards and Technology (NIST), the Optical Technology Storage Association (OSTA) and the DVD Association (DVDA) expanded the scope of testing in Phase 2. Phase 2 includes testing of DVD recordable drives and also includes a procedure to create test media.

Again the format for the testing is fairly simple, thus ensuring that the test methodology is available to users with non-technical backgrounds as well as more experienced users. A DVD-Video disc image authored using Daikin Scenarist NT will be used as the original source material. The title of this disc is the "Naxos Musical Journey Saint-Saens & Bizet" title. This title was released during 2001 by DVD International, and replicated by Panasonic Disc Services Corporation.

The test is designed to give the end user confidence in the recordability and playability of a particular brand of DVD writable media (including DVD-R (for general) and DVD+R) with the DVD drive in their computer.

The procedure described in this document is precisely what was used in the joint NIST/OSTA/DVDA Phase 2 DVD compatibility test. The plan may also be valid for other formats (such as rewritable) and can be modified (for example, firmware updates or alternative suitable PC configurations) so long as the principle elements of the test remain in place.

One of the main goals of Phase 2 was to compare results of DVD-ROM drive compatibility with the results from Phase 1 so as to identify any change in the state of compatibility among DVD-ROM drives.

Testing will take place at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD, and at Software Architects Inc. (SAI) in Bothell, WA.

2 Test Overview:

The test is divided into two main procedures, with each procedure consisting of a number of parts:

1st: Test disc creation and verification.

- Detection
- Direct byte-to-byte copy of source to destination disc.
- Verification.

2nd: DVD compatibility and playability test.

- Detection and playability.
- Byte to byte comparison of the test DVD and a DVD-ROM disc.
- Data rate drop test.
- Video and audio playback test.

TEST DISC CREATION:

Insert the blank recordable test disc into the test recordable drive and verify disc detection. If the disc is detected, this part of the test has passed. Otherwise, this combination of test recordable drive and recordable media is considered 'FAILED'.

Start the recording software and with verify mode enabled, perform an exact copy of the source to destination. If the exact recording with verification is successful, this portion of the test is considered passed. Otherwise, this combination of test recordable drive and recordable media is considered 'FAILED'.

Result number	Detection	Exact copy	Verification	Overall Result
1	Failed	Any result	Any result	FAILED
2	Passed	Failed	Any result	FAILED
3	Passed	Passed	Failed	FAILED
4	Passed	Passed	Passed	PASSED

'Any result' means that the result of that particular test (either pass or fail or not possible to perform) will not change the outcome of the overall result of the test.

DVD COMPATIBILITY:

Insert the recordable test disc (which has passed the disc creation procedure) into the test drive and verify playability. If the disc is able to spin-up in the drive and play immediately, this part of the test has passed. If the disc is unable to spin-up in the drive and play immediately, this part of the test has failed. Any disc/drive combination that fails this part of the test is questionable for any type of application and shall be considered 'FAILED'.

Perform byte for byte comparison and data rate drop test (in a single software test operation). If there are no byte-to-byte differences as indicated in the results window of the test software, then the byte-to-byte part of this test passed. If there are any byte-to-byte differences in any chapters, then the byte-to-byte part of this test failed. A drive/disc combination that has byte to byte differences is considered 'FAILED'. If there are no byte to byte differences (and the spin-up test passed), then this combination shall be considered 'PASSED'. The 'quality' of the pass will be decided based on the results of the data rate drop and visual/navigational tests.

If there are no data rate drops as indicated in the results window of the software, then the data rate part of this test has passed. If there are any chapters with some level of data rate drop, then the data rate drop part of this test has failed. This test is designed to detect moderate data rate drops and is an indication that the drive is having some level of difficulty reading the data. It does

not necessarily guarantee video play back problems, but will indicate parts of the disc that are likely to experience video and audio drop outs.

Perform audible/visual and navigational test. If there are no audible, visual or navigational then, the Visual/Navigational part of this test has passed. If there are any chapters with some level of audible, visual or navigational artifacts, then the Visual/Navigational part of this test has failed.

If there are no data rate drops and no audible, visual or navigational artifacts AND the spin-up and byte to byte tests passed, this drive combination shall be considered 'PASSED +'. If there are any data rate drops or any audible, visual or navigational artifacts AND the spin-up and byte to byte tests passed, this disc/drive combination shall be considered 'PASSED -'.

Result summary:

Result number	Spin- up	Byte to byte result	Data Rate Drop result	Video/audio result	Overall Result
1	Failed	Any result	Any result	Any result	FAILED
2	Passed	Failed	Any result	Any result	FAILED
3	Passed	Passed	Failed	Any result	PASSED -
4	Passed	Passed	Any result	Failed	PASSED -
5	Passed	Passed	Passed	Passed	PASSED +

'Any result' means that the result of that particular test (either pass or fail or not possible to perform) will not change the outcome of the overall result of the test.

3 System configuration:

In an effort to ensure the integrity of the results of this DVD compatibility investigation, all computer configurations should be the same and as described below. However, this test will be valid for any PC configuration that meets the requirements as specified by the manufacturer of the drive and the media being tested.

hp workstation xw4000 Convertible Minitower

hp workstation xw4000 Convertible Minitower,
Intel® Pentium® 4 Processor 2.40GHz/533,
256MB DDR/266 ECC (1X256),
ASUS GeForce V9280S graphics card,
40GB ATA/100 EIDE 7200rpm Hard Drive,
1.44MB Floppy Disk Drive,
HP GDR-8160B 16X DVD-ROM (reference drive),
Integrated Intel AC97 Audio,
Integrated Intel PRO/100 VM Network Connection,
PS/2 Scroll Mouse,
Easy Access Keyboard (PS/2, carbon),
Microsoft® Windows® 2000 Professional (SP 2).

plus

InterVideo WinDVD player,
Power DVD (comes with DVD drive),
Sonic RecordNow CD/DVD recording software.

The Information Access Division (IAD) of the National Institute of Standards and Technology (NIST) will provide two identical test systems for the purpose of this testing. One of these systems will be on temporary loan from the IAD to Software Architects Inc. for this complete phase of testing.

4 Test preparation and notes:

The software used in this test procedure uses the Advanced SCSI Programming Interface (ASPI), and therefore requires that an ASPI layer be installed to properly run the test program. The required ASPI layers are supplied to the test centers directly and available to others from the Adaptec website (www.adaptec.com). See Appendix I and follow the directions to install the ASPI layer on the test computer.

This test requires that Sonic RecordNow be installed on each computer. This software allows the exact copy of the source disc be made to the test disc and also performs verification of the copy. Details on the installation of this software are included in the Sonic RecordNow package. Sonic RecordNow allows the direct sector by sector copy of the 'Reference' disc and also allows the selection of the particular speed setting for recording. It also provides the option to verify if a recording has been successful.

Install the NIST DVD compatibility test software and place an executable on the desktop of the computer. This DVD compatibility test software will be provided directly to the test centers. Details on running this test software are given in Appendix II. For questions regarding this software, please contact Oliver Slattery at the following email address: ollie@nist.gov

The test procedure requires that InterVideo WinDVD be installed on each test machine. This is a computer program that acts as a DVD 'player'. It includes many (if not all) of the features of most set top DVD players. Among its features are 'Next Chapter', 'Title' and 'Menu', all of which will be used in the course of this test process. To access these features, click on the WinDVD icon on the desktop and right-click on the viewing window of the player. Another feature of WinDVD that will be used in this test process are the player selections 'Auto play' and 'Source'. These selections essentially allow the user to select which drive (should there be more than one) that the DVD player plays on insertion of a DVD disc. To access these selections, right-click on the viewing window of the player and select 'Setup' and then 'Preferences'.

This test procedure requires that only successfully created and verified media be tested for compatibility against the various DVD drives. However, in some cases, media may fail to be successfully created and/or verified using the media creation procedure. It is necessary to note any media that failed to be successfully recorded and verified and this data should be included in any reports resulting from this investigation.

It has also come to the attention of the test personal that in some instances, media with a particular speed rating noted on the its packaging did not match the speed rating as indicated by the internal media code and thus the actual burn speed. This issue, whenever it occurs, should also be noted and included in any reports resulting from this investigation.

For Phase 2 testing, all drives had their firmware updated to the latest version once prior to testing and at a date no later that when the testing commenced.

Test Data Sheet – Part 1 should be filled out for each test drive. Part 2 should be filled out for each test disc within a specific drive.

For this initial test phase, all test systems will be fully prepared as described here at the NIST test facility in Gaithersburg, MD.

5 Definitions:

Reference drive: This is a DVD-ROM drive that will read data from a reference DVD-ROM disc. The reference drive/disc combination is what the test drive/disc combination will be compared to in the byte-to-byte comparison. The DVD-ROM drive and DVD-ROM disc are chosen such that the testers can be sure that the byte data read from the reference drive/disc combination is accurate.

Test drive: This drive will be tested to ensure that it can play a number of different types of DVD recordable discs. It may be a DVD-ROM drive or some type of recordable DVD drive.

Recording drive: Drive in which an exact image of the reference disc is copied to a blank DVD recordable disc.

Reference disc: This is a DVD-ROM disc that will be used with the reference DVD-ROM drive such that the testers can be sure that the byte data read from the reference drive/disc combination is accurate. In this case, the reference disc is a DVD video version of “Naxos Musical Journey Saint-Saens & Bizet” for the full capacity test and a DVD video version of “The Call” for the limited version test.

Test disc: This disc can be of any of the following DVD disc types: DVD-ROM, DVD-R, DVD-RW, DVD+R or DVD+RW, DVD-RAM. This disc will be tested in the test drive to ensure that the test drive/disc combination can successfully read the data contained on the disc.

Byte-to-byte comparison: The byte data from selected sectors as read by the reference drive/disc combination are compared to the byte data from the same selected sectors as read from the test drive/disc combination.

Data rate drops: The inability of the drive to quickly read the data on the disc may require the drive to perform more than the usual error correction and retries and may result in incidences where there is a delay in retrieving the data to perform the test procedure. (Note: This does not necessarily mean that there will be byte-to-byte differences, but it just takes longer for the drive to figure out the correct data on the disc).

Video/audio artifacts: Visual or audible (or both) break-ups that appear upon playback of the video sequence.

Autoplay: Where, upon insertion of the disc into the appropriate drive, the DVD player on the computer (in this case – WinDVD) will open automatically and start to play the title.

Full capacity test disc: A test disc that contains 4.7GBs of data. Media in this category are DVD-R (for general use), DVD-RW, DVD+R and DVD+RW.

Verify: Following creation of the test media, the recording software will verify the bytes on the newly recorded media match those from the original reference disc. This occurs as part of the overall recording process just following the actual copying operation.

Recording Speed: The speed at which the content is burned onto the recordable disc.

Exact Copy: An exact sector-by-sector copy of the reference disc is made to the recordable test disc.

6.1 Media Creation plan:

Step 1: Recorder Installation and Check.

Step 1.1: Install drives.

Using basic tools and screws (generally supplied with the DVD drive), install both the DVD recorder and the source drive as described by their respective installation instructions. Software that accompanied the drives WAS NOT installed since particular software for both recording and playback were specified for this investigation.

Step 1.2: Verify that both DVD drives are detected by the operating system.

Open 'My Computer' and verify that there are two 'CD-ROM' drives in this folder. Fill in test data sheet – Result 1.

Step 2: Make exact copy of 'Reference' disc onto a blank 'Test' disc.

Step 2.1 Set speed of recording

Open Sonic RecordNow! and click on the options (wrench on the right hand side of the upper window). Select 'Advanced' under the 'General' options. Select the maximum recording speed and click 'OK'.

Step 2.2 Activate 'Verify' mode.

Using Sonic RecordNow!, click on the options (wrench on the right hand side of the upper window). Select 'Data' in the left hand window. Ensure that the 'Verify data written to the disc after burning' box is checked.

Step 2.3: Copy disc.

Use the following steps to make an exact copy with the 'verify' option activated.

Using Sonic RecordNow!, select the 'Backup Project' tab. Click on the 'Exact Copy' option from the selections in the lower window. Follow the three steps described, using the 'Reference' disc and a blank 'Test' disc for steps 1 and 2 respectively. Click 'Copy'.

Note whether the disc has been successfully recorded and verified and note that actual burn time – Fill in data test sheet – Result 2.

6.2 DVD Compatibility Test:

Step 1: Drive Installation and Check.

Step 1.1: Install drives.

Using basic tools and screws (generally supplied with the DVD drive), install both the reference and test drive as described by their respective installation instructions. Software that accompanied the drives WAS NOT installed since particular software for both recording and playback were specified for this investigation. Ensure that the reference drive is set to 'Master' and the test drive is set to 'Slave'.

Step 1.2: Verify that both DVD drives are detected by the operating system.

Open 'My Computer' and verify that there are two 'CD-ROM' drives (both the reference and test) in this folder. Fill in test data sheet – Result 3.

Step 1.3: Set the reference drive to 'autoplay'

Set the test drive as the default drive and activate the autoplay feature in WinDVD.

Step 1.6: ROM to ROM test.

Perform Steps 2 – 4 as described below using a "Saint Saens and Bizet" DVD-ROM disc as a reference disc and another "Saint Saens and Bizet" DVD-ROM disc as a test disc. Repeat 'Step 3' three times. Fill in test data sheet – Result 4.

Continue to Step 2 for the entire set of test discs.

Step 2: Disc detection and autoplay test.

Step 2.1: Insert DVD test disc into test drive and confirm autoplay.

Confirm that the FBI warning plays automatically and immediately once the DVD is inserted. Stop the player. Fill in test data sheet – Result 5.

Step 3: Byte to Byte comparison and Data Rate test.

Step 3.1: Insert the reference DVD-ROM disc into the reference drive and the writable DVD test disc into the test drive.

Step 3.2: Open NIST test software.

Open the NIST Byte-to-Byte comparison software. Details on how to operate this program will follow. See Appendix II.

Step 3.3: Select the 'Reference Drive' and the 'Test drive'.

Confirm that the reference drive and test drive are detected and displayed in the 'Reference Drive' and 'Test Drive' box respectively. If the wrong drives are selected, press 'Select Reference Drive' to select the reference drive and 'Select Test Drive' to select the test drive.

Step 3.4: Press 'Start Test' to perform the test.

Once the test has started, it must be allowed to finish completely. The length of time the test will take will vary depending on the quality of the media and the compatibility of the drive/media combination. A perfect test (no byte-to-byte difference and no data rate drops) will take about 2 minutes. If the drive has difficulty in reading the data from the disc, it will continue to try and therefore the test may take a very long time.

If you need to stop the test, you should do so by the Windows Task Manager (by pressing Ctrl + Alt + Delete together). **However, the drives will be in a locked state and you will need to run the 'NIST Unlock Drives.exe' program to unlock and reset the drives.**

Fill in the data test sheet – Results 6 and 7.

Step 4: Visual/Navigation test.

Step 4.1: Insert test DVD test disc into test drive and confirm autoplay.

Confirm that the following sequence is played:

FBI warning for approximately 6 seconds.
DVD International Logo for about 30 seconds.
Saint-Saens and Bizet title screen for approximately 10 seconds.

Note: It may be necessary to eject and re-insert the DVD test disc into the test drive to confirm autoplay. Fill in test data sheet – Result 8.

Step 4.2: Visually inspect each chapter of the test disc.

Right-click on the viewing window of WinDVD and select 'Next Chapter' to visually inspect each chapter. Watch approximately 10 seconds of these chapters and watch for any video or audio artifacts. Record any such artifacts. Fill in test data sheet – Result 9.

Step 4.3: Confirm navigation to the title menu.

Right-click on the viewing window, select from the 'Menu' button the 'Title Menu'. Confirm that the title menu appears in the viewing window. Fill in test data sheet – Result 10.

Step 4.4: Confirm playing of the title menu segments.

Position the mouse over and click on the 'Video Essentials' segment and confirm that this segment starts to play. Watch for and record any visual or audible artifacts. Stop the WinDVD player. Fill in test data sheet – Result 11.

Replace the test disc and repeat steps 2 – 4 for each test disc.

Note:

Confirm that the test data sheet is completely filled out before moving on to the next disc.

Test Data Sheet – Part 1.

Section 1: Test Information:

Test Facility:	Date:
Reference Drive:	Disc Title: Saint-Saens and Bizet OR The Call

Section 2: Drive Information:

Reference Drive Make:	Reference Drive Model:
Recording Drive Make:	Recording Drive Model:
Test Drive Make:	Test Drive Model:

Section 3: Media Creation:

Installation of recorder and reference drive:

Result 1	Pass/Fail	Comments

Media copy and verify and note burn time:

Result 2	Pass/Fail	Actual Burn Time	Comments

Section 4: DVD compatibility test:

Installation of test drive drive:

Result 3	Pass/Fail	Comments

Drive Calibration (Result 4):

Chapter #	Byte-Byte (Pass/Fail)			Comments	Data Rate (Pass/Fail)			Comments	Visual / Audible	Comments
Chapter 1										
Chapter 2										
Chapter 3										
Chapter 4										
Chapter 5										
Chapter 6										
Chapter 7										
Chapter 8										
Chapter 9										
Chapter 10										
Chapter 11										
Chapter 12										
Chapter 13										
Chapter 14										
Chapter 15										
Chapter 16										
Chapter 17										
Chapter 18										
Chapter 19										
Chapter 20										
Chapter 21										
Chapter 22										
Video Essentials										

Continue to Data Test Sheet – Part 2. If the test disc is DVD-R (General), DVD-RW, DVD+R or DVD+RW, please use the 'Full Capacity' data test sheet. If the test disc is DVD-RAM, please use the 'Limited Capacity' data test sheet.

Test Data Sheet (Full Capacity) – Part 2
(Each test disc).

Drive	Disc #	Reference Disc Title
		Saint Sens and Bizet

Autoplay test:

Result 5	Pass/Fail	Comments

Byte-to-Byte test (Result 6) and Data Rate test (Result 7):

Chapter #	Result 6: (Pass/Fail)	Comment	Result 7: (Pass/Fail)	Comments
Chapter 1				
Chapter 2				
Chapter 3				
Chapter 4				
Chapter 5				
Chapter 6				
Chapter 7				
Chapter 8				
Chapter 9				
Chapter 10				
Chapter 11				
Chapter 12				
Chapter 13				
Chapter 14				
Chapter 15				
Chapter 16				
Chapter 17				
Chapter 18				
Chapter 19				
Chapter 20				
Chapter 21				
Chapter 22				
Video Essentials				

Visual/Navigation test:

Result #	Pass/Fail	Comments
Result 8		
Chapter Number	Result 9 (Pass/Fail)	Comment
Chapter 1		
Chapter 2		
Chapter 3		
Chapter 4		
Chapter 5		
Chapter 6		
Chapter 7		
Chapter 8		
Chapter 9		
Chapter 10		
Chapter 11		
Chapter 12		
Chapter 13		
Chapter 14		
Chapter 15		
Chapter 16		
Chapter 17		
Chapter 18		
Chapter 19		
Chapter 20		
Chapter 21		
Chapter 22		
Result 10		
Result 11 (Video Essentials)		

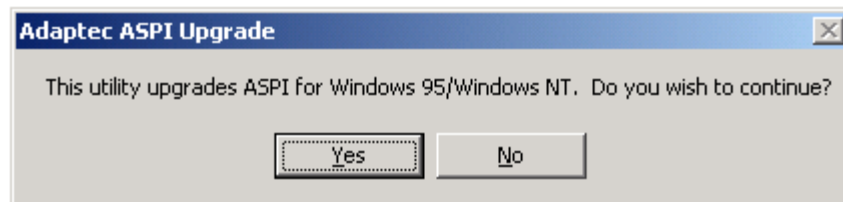
Appendix I:

Installing the required ASPI layer

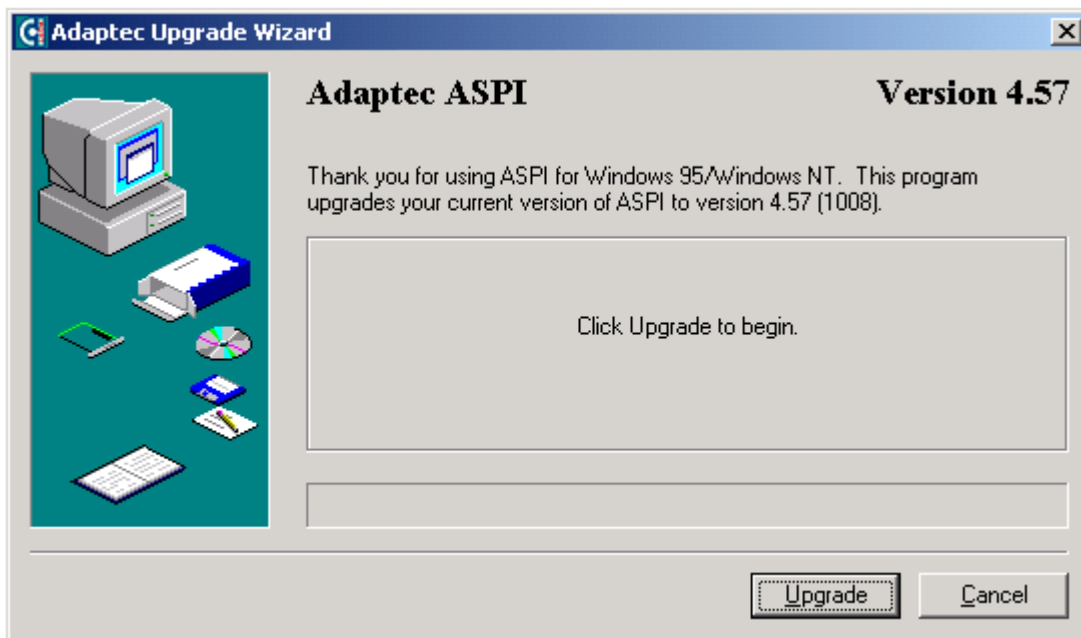
You will need to install two executables in order to ensure that your system can perform the DVD compatibility test correctly. Please note that this will require that you restart your system twice. These installations should not effect the operation of your system. Both of these executables are included in the DVD Compatibility test package in Install_ASPI.zip. Unzip this file and click on the aspiinst.exe icon as shown in the following figure:



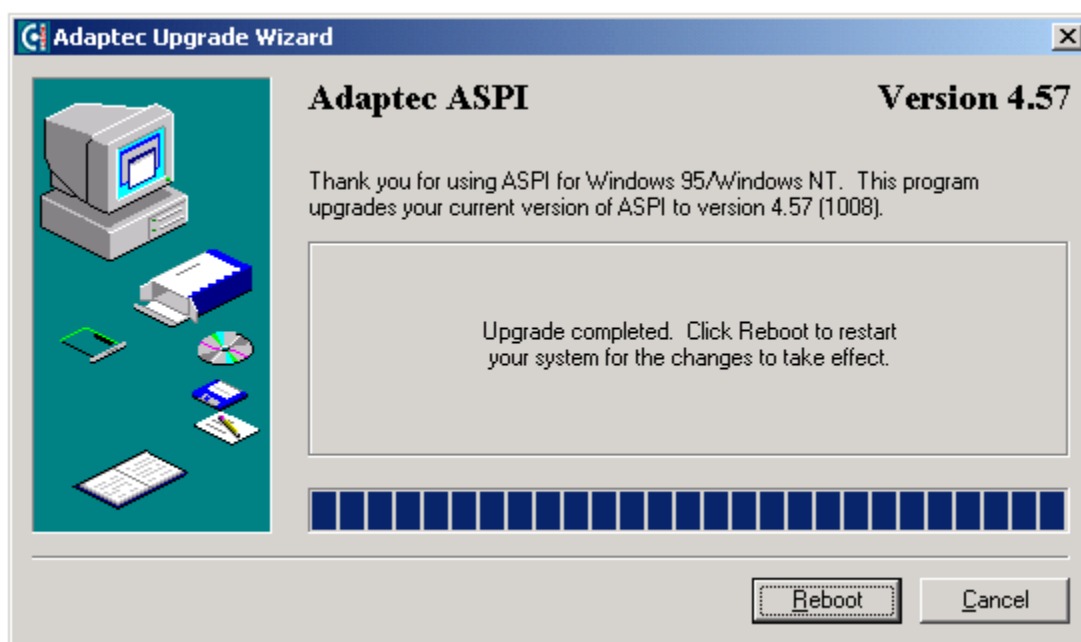
Once you click on this icon, the following Adaptec message box appears:



Click 'Yes' to continue and the following Adaptec installation wizard window will appear:



Click 'Upgrade' as instructed and the following reboot request will appear:



Click 'Reboot' as instructed. Once your system has restarted you will need to reopen the Install_ASPI folder and repeat the installation for the aspi32.exe icon shown below:



aspi32.exe

Following the second reboot of your system, you should NOW be ready to perform the DVD compatibility test as normal.

Appendix II:

NIST Byte-to-Byte Test for DVD

Before Starting :-

The test package contains a number of files that are important to successfully perform the test and to help recover from aborted tests. Two of these files are shown below:



Fig 1: The test icons

The 'NIST Byte to Byte Test for DVD.exe' will start the test window and is described in detail below. The 'NIST Unlock Drives.exe' will unlock the test and reference drives should you need to abort the test.

The Test :-

The 'NIST Byte-to-Byte Test for DVD' performs two functions as part of the DVD compatibility testing for DVD-ROM computer drives. Firstly, it compares the byte data from a DVD-ROM disc (referred to as the 'Reference Disc') to the byte data from a writable (either DVD-R, DVD-RW, DVD+R or DVD+RW) DVD disc (referred to as the 'Test Disc'). Secondly, it alerts any serious drop in data rate from the Test Disc to the cache of the drive reading the Test Disc (referred to as the 'Test Drive'). A good quality disc been read by a good quality drive should have both perfect byte data as well as little or no data rate drops.

To open the 'NIST Byte-to-Byte Test for DVD', click on the icon shown in Fig 1. Once you click on this icon, the main test window will appear as follows:

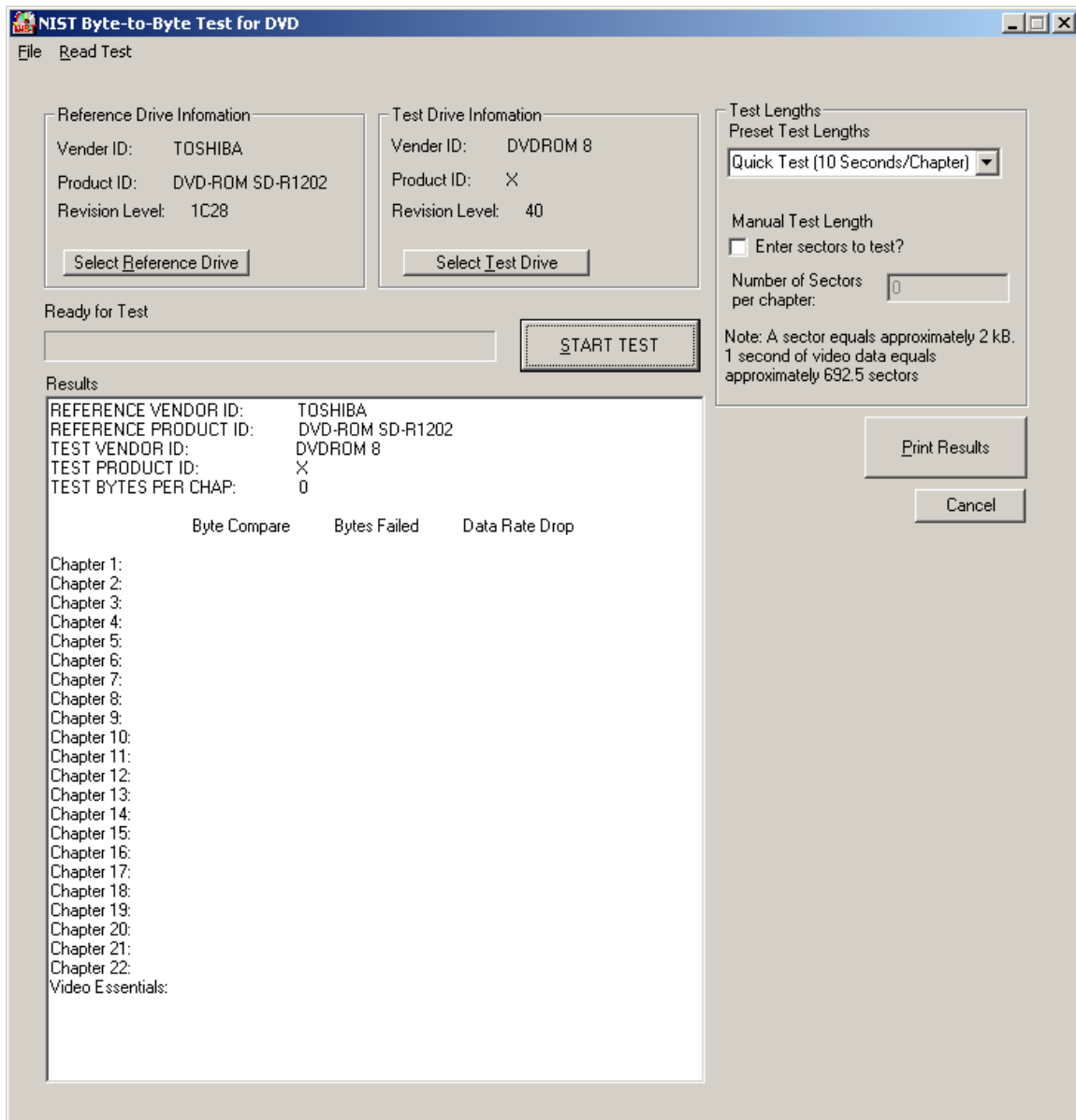


Fig 2: The 'NIST Byte-to-Byte Test for DVD' start window

You will now need to confirm that the DVD drive shown in the 'Reference Drive Information' is the reference drive you wish to use for the testing. Likewise, you need to confirm that the DVD drive shown in the 'Test Drive Information' is the test drive you wish to use for the testing. If either of these drives are not the required drives to be used in the test, you can press the 'Select Reference Drive' or the 'Select Test Drive' to change the drive selection as shown in Fig 3.

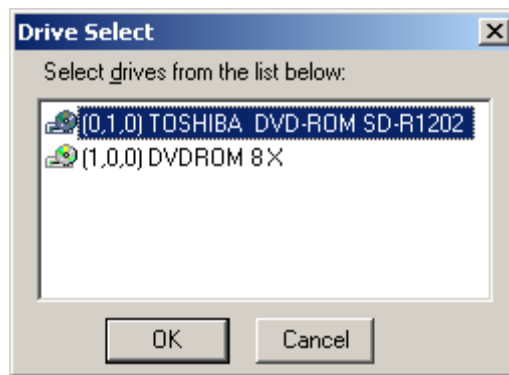


Fig 3: The drive select window.

You can choose any of the drives in the Drive Select window to be either the 'Reference Drive' or the 'Test Drive'. Once you have selected the Reference and Test drives, you can change the test length. The default test length is 6925 sectors or approximately 10 seconds of video data at a bitrate of 14MB- 15MB per second. This test length is termed "Quick Test (10 seconds/chapter)". However, the test length is set in sectors and therefore the time approximation may vary depending on the bitrate at various points on the disc. It is possible to change the test length from the default to twice the default (13850 Sectors) and is termed "Medium Test (20 seconds/chapter)" or to six times the default (41550 sectors) and is termed "Long Test (60 seconds/chapter)". To change the length of the test, simply click on the pull down selection in the 'Test Length' area of the test interface and select the desired length, as shown in Fig. 4 below.

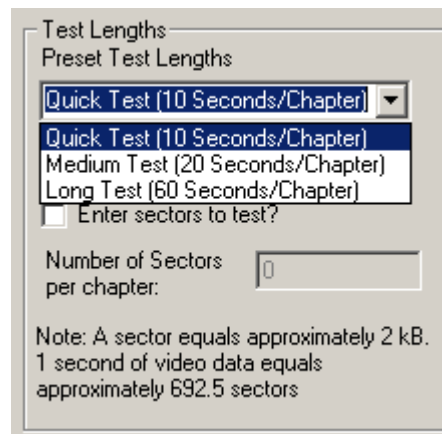


Fig 4: The selection of the test length.

It is also possible to select a manual length of the test by checking the 'Manual Test Length' box and entering the number of sectors you wish to test in the provided area. In the case where a manual value is entered, and where that value is greater than the number of sectors in the chapter, the test will automatically 'cap' the test length at any one chapter to the length of that chapter. This will prevent repeat testing of the same sectors and will also prevent the test attempting to read sectors that out of range or not even existent on the disc.

The Test process:-

Once the test has been set up, you can press the 'Start' button to begin the byte to byte comparison and data rate testing. The first action of the test code is to ensure that there are reference and test disc in the drives. You will receive a message alerting you to this and you will need to confirm for both the test and reference drives as shown below:

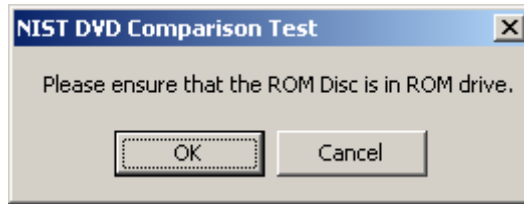


Fig 5: Ensuring the discs are inserted.

If both disc are in place, the test will commence automatically. If, however, there is no disc in either drive or the drive is cannot detect the disc, the following message will appear:

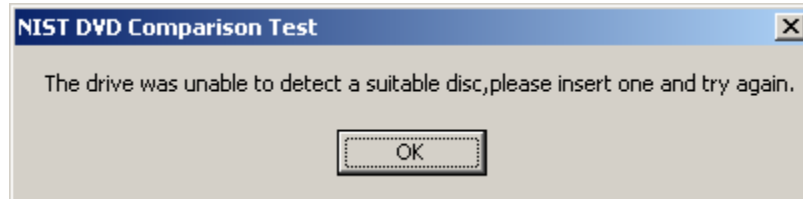


Fig 6: Alert that the drive was unable to find the disc.

It is necessary to insert a disc at this point and try again. If there is already a disc in the drive, but the drive is not detecting the disc, it is recommended that you eject and insert the disc a number of times to see if the drive can detect the disc (and this should be noted in the results data sheet).

Once both drives have detected both the reference and test discs, the test will begin and the progress window will indicate the progress of each chapter. The results will be updated automatically after every chapter as shown in Fig 7 below:

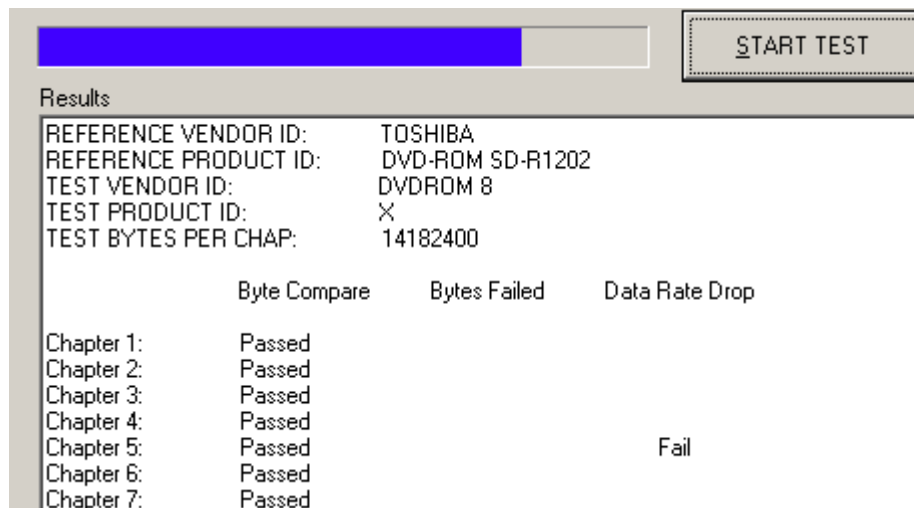


Fig 7: Progress bar for each chapter and results.

If there are no byte to byte differences detected and no serious data rate drops, the results will show that the 'Byte Compare' portion of the test 'Passed' for all chapters and will not show any indication of 'Bytes Failed' or 'Data Rate Drop'. If there are no byte to byte differences but with some data rate drops, the test will show that the 'Byte Compare' portion of the test 'Passed' for all chapters and the 'Data Rate Drop' has a 'Fail' under its column. If there are byte to byte differences, the 'Byte Compare' portion of the test 'Failed' for the chapters in which differences were detected and will indicate the number of bytes in the tested portion of the chapter that failed.

The results box will give the summary of the results for each test disc to be noted in the results data sheet.

Once the test is complete, there will be an alert as to the overall result of the test. For example, if the 'Byte Compare' of the test disc passed but there were indications of data rate drop, the following alert will appear at the end of the test:

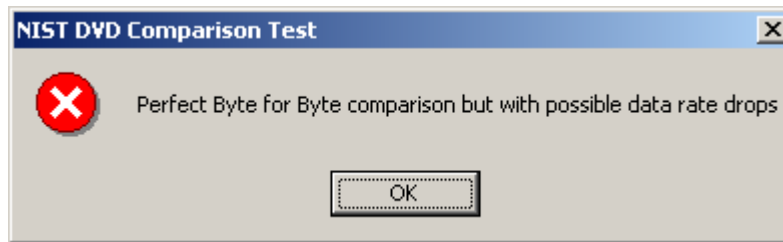


Fig 8: Alert indicating of the overall test result.

You will then be given the option to save the results as a text file. You can also print the test results sheet directly from the test window by pressing the 'Print results' button of the window.

Aborting the test :-

Aborting the test should be necessary if a drive is unable to read the data from the disc and the progress is exceptionally slow and therefore not worth completing. This can be done using the windows task manager (by pressing Ctrl + Alt + Delete together), highlighting the 'NIST Byte-to-Byte Test for DVD' listing and selecting 'End Task'. However, aborting in the middle of the test will leave the drives locked. To unlock the drives, click on the 'NIST Unlock Drives.exe' icon and click the 'Unlock Drives' button (Fig. 9 below) to unlock the drives and start another test.

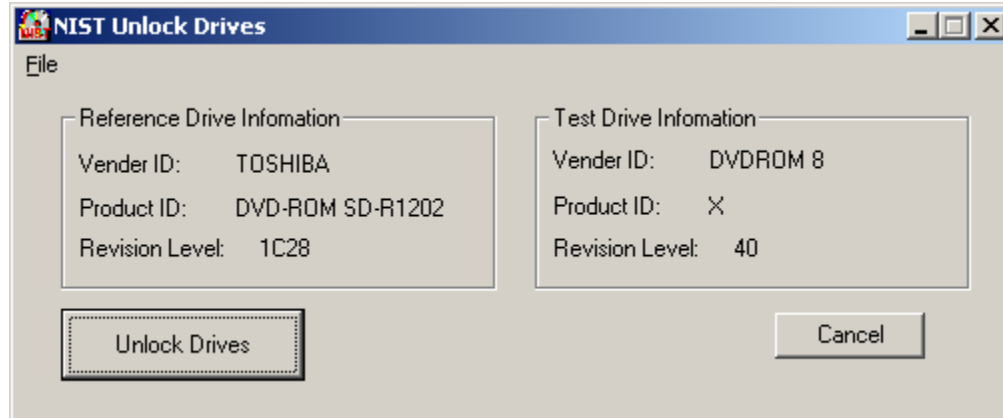


Fig 9: Unlocking the drives.